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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

**Appellants:** Donald R. Huffman, et al.

**Serial No.:** 08/236,~~937~~ 933

**Filed:** May 2, 1994

**For:** NEW FORM OF CARBON

**Art Unit:** 1754

**Examiner:** P. DiMauro

**Docket:** 7913ZAZY

**Dated:** April 30, 2001



# BRIEF ON APPEAL

Mark J. Cohen
Attorney for Appellants
Registration No.: 32,211

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza
Garden City, New York 11530
(516)742-4343

## TABLE OF CONTENTS

**PAGE**

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Assistant Commissioner for Patents
Washington, DC 20231



**APPEAL BRIEF**

Sir:

## I. INTRODUCTION

Appellants, through their attorney, hereby submit this Brief on Appeal pursuant to 37 C.F.R. §1.192 in response to the decision of the primary Examiner, mailed August 7, 2000, finally rejecting Claims 46-49, 51-84, 96, 181 and 203-248.

## II. REAL PARTY IN INTEREST

The real party in interest in the above-identified appeal who has been assigned the entire right, title and interest in the above-identified application is Fullerene International Corporation located at 9 East Loockerman Street, Dover, Delaware.

## III. RELATED APPEALS AND INTERFERENCES

Copending Application having U.S. Serial No. 08/486,669 filed on June 7, 1995 is also on appeal. The '669 application is a continuation of U.S. Serial No. 236,933 filed on May 2, 1994, which is a continuation of U.S. Serial No. 855,959, filed on March 23, 1992, which is a divisional of U.S. Serial No. 508,246 filed on September 10, 1990 which is a CIP of USSN

575,254 filed August 30, 1990.

In addition, U.S. Serial No. 07/580,246 which was filed on September 10, 1990 was involved in Interference No. 103,201 in which priority was awarded to applicants Huffman and Kratschmer. A copy of this decision was filed in this application and is part of the file wrapper, as acknowledged by the United States Patent and Trademark Office in the Final Rejection dated August 7, 2000.

## IV. STATUS OF CLAIMS

The present application was filed on May 2, 1994 and is a continuation of U.S. Serial No. 855,959 filed on March 23, 1992 which is a continuation of U.S. Serial No. 781,549, filed on October 22, 1991, which is a divisional of U.S. Serial No. 580,246, filed September 10, 1990, which is a C-I-P of U.S. Serial No. 575,254, filed August 30, 1990.

When the present application was filed, applicants cancelled Claims 1-44 of the original specification and added Claims 45-180 in a Preliminary Amendment dated June 20, 1994. In an Amendment dated June 19, 1995, Claims 85-95 and 97-159 were cancelled without prejudice, Claims 45, 50, 62-64, 66, 96 and 160 were amended and Claims 181-203 were added thereto. In an amendment dated April 4, 1996, Claims 45, 46, 47, 48, 50, 51, 52, 53, 58, 62, 63, 64, 65, 83, 84, 160, 163, 165, 169, 170, 171, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 192, 193 and 203 were amended, and Claims 204-231 were added. The Response dated January 7, 1997 cancelled Claims 160-180 and 182-202 and amended Claims 45, 50, 66, 67, 68, 69, 70, 71, 83, 84, 181, 204, 212, 213, 222 and 230. Further, the Response dated September 22, 1997 amended Claims 45, 50, 67, 83, 84, 181, 204, 213, 222 and 230. Subsequent thereto no further amendments have been made to the claims.

The pending claims are 45-49, 51-84, 96, 181 and 203-248. These claims which are the subject of the appeal are set forth in Exhibit A of the Appendix of this Appeal Brief, attached hereto. Each of these claims have been finally rejected and are on appeal.

## V. STATUS OF AMENDMENTS

No amendment has been filed after the issuance of the Final Rejection.

## VI. SUMMARY OF THE INVENTION

The Claims on appeal are directed to a process for preparing $C_{60}$ in amounts that have not been realized heretofore. The $C_{60}$ is in solid form, in fact, it is a colored solid, as described on Page 7, Lines 11-18 and in Example 1. The methodology for preparing $C_{60}$ in these amounts is described on Pages 3, Line 25 to Page 7, Line 25 and in the exemplification, especially Example 1. The specification also describes and characterizes the product produced, using such techniques as IR, UV, X-ray diffraction pattern.

The claims define various embodiments of the present invention. In one embodiment, recited in Claim 45, the present invention is directed to a process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to form a sooty carbon product comprising $C_{60}$ molecules, said $C_{60}$ molecules being present in said sooty carbon product in amounts capable of extracting therefrom said $C_{60}$ in macroscopic amounts and in solid form; and

(b) extracting $C_{60}$ in macroscopic amounts.

This methodology is described on Page 3, Line 25 to Page 27, Line 25 of the instant specification, which describes the vaporization of carbon and the quenching thereof by

an inert quenching gas to form a sooty carbon product. As described therein, the $C_{60}$ is separated from the sooty carbon product by such techniques as extraction or sublimation.

Evidence that the $C_{60}$ produced was in macroscopic amounts is also supported by the underlying disclosure. For example, attention is directed to Example 1, wherein it discloses that the product formed was a solid, and in fact was a powdered solid. Moreover, the powder was colored, being brownish red. Such a description connotes to one of ordinary skill in the art that the $C_{60}$ product could be seen and felt, i.e., it was produced in macroscopic amounts. See, also discussions hereinbelow under Arguments for Patentability.

In another embodiment, as recited in Claim 83, the $C_{60}$ is prepared by

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to form a sooty carbon product comprising $C_{60}$ molecules, said $C_{60}$ molecules being present in said sooty carbon product in amounts sufficient to be capable of providing a visibly colored solution when extracted with sufficient amount of benzene; and

(b) extracting $C_{60}$ from said sooty carbon product in amounts sufficient to provide a visibly colored solution when extracted with benzene in amounts sufficient to dissolve the $C_{60}$ present in said sooty carbon product.

The process for vaporizing and quenching the $C_{60}$ is as described hereinabove, and the comments thereof are incorporated by reference. However, the claims additionally recite that the $C_{60}$ is produced as a visibly colored solution when extracted with benzene. As indicated, for example, on Page 7, Lines 10-11 of the instant specification, when the sooty carbon product was placed in benzene, a brownish red solution was produced. Attention is also directed to Example 1 which indicates that the solution containing the sooty carbon

product was wine red to brown in color, thereby evidencing again that the solution was colored.

In a third embodiment, as recited in Claim 84, the present invention is directed to a process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to provide a sooty carbon product comprising $C_{60}$ molecules, said $C_{60}$ molecules being present in said sooty carbon product in amounts sufficient to be capable of providing a visibly colored solution when extracted with benzene;

(b) depositing the sooty carbon product on a collecting surface;

(c) removing the sooty carbon product from the collecting surface; and

(d) extracting product which is predominantly $C_{60}$ from said sooty carbon product, said $C_{60}$ being present in sufficient quantities to provide a visibly colored solution when extracted with benzene present in amounts sufficient to dissolve the $C_{60}$ present in said sooty carbon product.

In this embodiment, the first step is the same as the previous embodiment; reference is made to the discussions hereinabove with respect to the first step on the previous page. As explained on Page 5, Lines 9-20 of the instant specification, the sooty carbon product produced from the first step is deposited on a collecting surface which is inert to the vaporized carbon and which is located in the path of the carbon smoke. As further described on Page 5, Lines 15-20 of the instant specification, the sooty carbon product is removed from the collecting surface, such as by scraping the sooty carbon product from the coated surface. See also Page 7, Lines 6-10 of the instant specification. The sooty product thus removed can

then be placed in an extracting solvent, e.g., a non-polar solvent, such as benzene, in which the $C_{60}$ molecules are soluble therein. See Page 5, Lines 18-28 of the instant specification. When the $C_{60}$ is dissolved in benzene, the benzene solution becomes colored. See, Page 7, Lines 10-11 and Example 1 of the instant specification.

A fourth embodiment is recited in Claim 181. It is directed to a process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to form a sooty carbon product comprising $C_{60}$ molecules, said $C_{60}$ molecules being present in said sooty carbon product in amounts capable of extracting $C_{60}$ therefrom said $C_{60}$ in solid form; and

(b) extracting in solid form $C_{60}$ from said sooty carbon product.

The first step in the process includes vaporizing elemental carbon in the presence of an inert quenching gas to form the sooty carbon product. This aspect of the first step is as described hereinabove in the discussions referring to the first embodiment, and the discussions therein are incorporated herein by reference. However, in this embodiment, the $C_{60}$ is present in the sooty carbon product in amounts capable of being extracted therefrom as a solid. Support for the formation of $C_{60}$ as a solid in the process described in the application is found throughout the specification. Attention is directed to Page 7, Lines 11-17 of the instant application which discloses that a microcrystalline product is formed. A microcrystalline product, is, by definition, a solid. Moreover, the same passage discloses that the product obtained can be sublimed, which again indicates that the product is a solid. Further attention is directed to Page 8, Line 8 to Page 11, Line 14 of the instant specification

which describe the crystal structure of $C_{60}$, as observed under an optical microscope and by X-ray diffraction. Finally attention is directed to Example 1, which describes the initial product obtained as a microcrystalline residue which upon purification by sublimation formed a powder. All of these descriptions are evidence that the product obtained from the present process is a solid and more specifically a crystalline solid.

In a further embodiment, recited in Claim 204, the present invention is directed to a process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas at a pressure sufficient to generate a sooty carbon product comprising $C_{60}$, said $C_{60}$ being present in said sooty carbon product in sufficient amounts to produce and collect therefrom crystalline $C_{60}$; and

(b) separating the $C_{60}$ from the sooty carbon product under conditions effective to recover crystalline $C_{60}$.

Support for this embodiment is also found in the specification. See, the discussions of the previous embodiment, the contents of which are incorporated by reference. Moreover, as described hereinabove, the underlying specification describes methods such as extraction with a non-polar solvent and/or sublimation to produce a crystalline $C_{60}$. See, for example, Page 5, Line 8 to Page 6, Line 5; Page 7, Lines 11-17; and Example 1 of the instant specification.

Claim 213 is directed to another embodiment of the present process. It recites a process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon to form carbon vapor in an atmosphere of an

inert gas;

(b) quenching said carbon vapor in said inert gas under conditions sufficient to effectively condense and nucleate said vapor to form a sooty carbon product comprising $C_{60}$ molecules in sufficient quantity to extract therefrom an amount sufficient to collect said $C_{60}$ as a crystalline carbon;

(c) collecting the sooty carbon product; and

(d) separating said $C_{60}$ from said sooty carbon product and recovering therefrom said $C_{60}$ in crystalline form.

This claim recites a variation of the process recited hereinabove. The first step in the process is vaporizing elemental carbon to form carbon vapor in the presence of an inert gas, as described on Page 3, Line 2 to page 4, Line 10 of the instant specification. The second step is quenching the carbon vapor to condense and nucleate the vapor to form the sooty carbon product, which is also described on Page 3, Line 26 to Page 4, Line 10 of the instant specification. In the next step, the sooty carbon product is collected, such as by scraping off the collecting surface. See Page 5, Lines 9-18 of the instant specification. As described in the specification, under the conditions described therein, the $C_{60}$ extracted from the sooty carbon product is a solid, e.g., in crystalline form. See, e.g., Page 7, Lines 11-17 of the present specification that discloses that a microcrystalline form is produced. Moreover, attention is directed to Page 8, Line 8 to Page 11, Line 14 of the instant specification which discloses the crystal structure of $C_{60}$ produced in accordance with the present invention. Furthermore, as described in Example 1, the initial product obtained is a microcrystalline solid. Thus, the process described in the application produces a sooty carbon product with $C_{60}$ being present

therein in an amount sufficient to collect $C_{60}$ as a crystalline solid.

Another embodiment of the instant invention is recited in Claim 222. It is directed to a process for producing of $C_{60}$ comprising:

(a) vaporizing elemental carbon in an atmosphere of an inert gas at a pressure sufficient to generate a sooty carbon product comprising $C_{60}$, said $C_{60}$ being present in sufficient quantities to recover therefrom $C_{60}$ in amounts to be discernible as a colored solid; and

(b) separating said $C_{60}$ from said sooty carbon product under conditions effective to recover therefrom a colored crystalline $C_{60}$.

The present specification describes the effect of pressure on the $C_{60}$ product being ultimately formed. See, for example, Page 4, Lines 16 to Page 5, Line 6 of the instant specification. As stated therein, at lower pressures, such as subatmospheric pressure, relatively pure $C_{60}$ can be produced. See, Page 6, Lines 8-16 of the instant specification. The $C_{60}$ is produced, as exemplified by the specification, as a colored solid. See for example, Example 1. The separation of $C_{60}$ from said sooty carbon product is described in the specification at various passages such as for example, on Page 5, Line 18 to Page 6, Line 5 of the instant specification.

In a further embodiment, described in Claim 230, the present invention is directed to a process for preparing $C_{60}$ comprising vaporizing elemental carbon selected from the group consisting of graphite, amorphous carbon and glassy carbon in an inert quenching gas at a pressure of at least 50 torr so as to generate a carbon sooty product comprising $C_{60}$ and separating said $C_{60}$ from said sooty carbon under conditions effective to recover

substantially pure crystalline $C_{60}$ therefrom.

This embodiment differs from the other embodiments in that it identifies the elemental carbon, provides a minimum pressure and indicates that the $C_{60}$ separated from the sooty is a substantially pure crystalline $C_{60}$. This process is supported by the description, as described above on Page 3, Line 25 to Page 7, Line 25 of the specification. The specification provides three examples of elemental carbon on Page 4, Lines 9 and 10 thereof. It also indicates that in a preferred embodiment, the pressure ranges from about 50-400 torr. See, Page 4, Lines 23-25 of the instant specification. The specification describes various methods for separating $C_{60}$ from the sooty carbon product, as described hereinabove, the contents of which are incorporated by reference. See, for example Page 5, Line 18 to Page 6, Line 5 of the instant specification. Moreover, the specification teaches that at low pressures, the $C_{60}$ produced is substantially pure. For example, the specification teaches at 100 torr, the $C_{60}$ produced is 98% $C_{60}$ and 2% $C_{70}$, and at 50 torr the $C_{60}$ product is predominantly $C_{60}$. See, Page 4, Lines 16-25 and Page 6, Lines 8-22 of the instant specification.

The process recited in Claim 232 defines another embodiment. It is directed to a process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to form a sooty carbon product comprising $C_{60}$ molecules in macroscopic amounts;

(b) depositing the sooty carbon product on a collecting surface remote from said situs of vaporization;

(c) removing the sooty carbon product from the collecting surface; and

(d) extracting a product comprising a macroscopic amount of $C_{60}$ from said sooty carbon product.

The vaporization step and the production of macroscopic amounts of $C_{60}$ were discussed hereinabove with respect to the first embodiment, and the discussions thereof are incorporated by reference. In this variation, the clams recite that the sooty carbon product is deposited on a collecting surface remote from the site of vaporization. For example, the specification discloses on Page 5, Lines 14-16 that the collecting surfaces are located in the path of the carbon smoke. Moreover, Example 1 discloses that the collecting substrates were placed 5-10 cm from the evaporating carbon rods.

As described hereinabove, the specification describes the removal of the sooty carbon product from the collecting surface. See, e.g., Page 5, Lines 8-15 of the instant specification. Finally, as shown above, in the discussion of the first embodiment and hereinbelow, the specification supports extraction of macroscopic amounts of $C_{60}$ from the sooty carbon product. The discussions of the first embodiment hereinabove and the discussions hereinbelow under Arguments for Patentability addressing the issue of support for "macroscopic amounts of $C_{60}$" are incorporated herein by reference.

Another embodiment is recited in Claim 233 and is directed to a process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas at a pressure ranging from less than 1 atmosphere to a pressure of 10 atmospheres under conditions effective to form a sooty carbon product comprising $C_{60}$ in quantities sufficient to isolate $C_{60}$ as a solid when extracted from the sooty carbon product;

(b) depositing the sooty carbon product on a collecting surface remote from said situs of vaporization;

(c) removing the sooty carbon product from the collecting surface; and

(d) extracting $C_{60}$ from said sooty carbon product in quantities sufficient to isolate $C_{60}$ as a solid when extracted from the sooty carbon product.

This methodology is described in the instant specification. For example, attention is directed to Page 3, Line 26 to Page 4, Line 15 and Page 6, Line 22 to Page 7, Line 10 which describes the vaporization of the elemental graphite. The discussion on Page 4, Line 16 to Page 5, Line 6 refers to the effect of pressure on the process for forming $C_{60}$ and provides support for the pressure ranging from less than 1 atmosphere up to a pressure of 10 atmospheres.

Steps (b) and (c) are identical to steps (b) and (c) in Claim 232; reference is made to the discussions therein for support thereof. Step (d) is directed to a step of extracting the $C_{60}$ from the sooty carbon product in an amount sufficient to isolate $C_{60}$ as a solid. This connotes that a sufficient amount of $C_{60}$ is produced so that it could be isolated as a solid. As described in the specification, the present process produces $C_{60}$ as a solid. Support thereof is found throughout the specification, see, for example Page 7, Lines 11-17 of the instant specification which discloses that a microcrystalline product is formed. A microcrystalline product is by definition, a solid. Moreover, the same passage discloses that the product obtained can be sublimed, which again indicates that the product is a solid. Furthermore, attention is directed to Page 8, lines 8 to Page 11, Line 14 which describes the crystal structure

of $C_{60}$. Finally, attention is directed to Example 1, which describes the product as a powder. All of these descriptions evidence that the product obtained was isolated as a solid.

In another embodiment, recited in Claim 234, the present invention is directed to a process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under a pressure ranging from less than 1 atmosphere up to 10 atmosphere under conditions effective to form a sooty carbon product comprising $C_{60}$ in quantities sufficient to isolate $C_{60}$ as a discernible solid when extracted from the sooty carbon product; and

(b) extracting $C_{60}$ from said sooty carbon product in quantities sufficient to isolate said $C_{60}$ as a discernible solid.

This claim differs from the previous claim in that it specifically recites that solid $C_{60}$ is formed in sufficient amounts so that it is discernible as a solid. As described in the specification, in various passages, such as Page 7, Lines 11-17, Page 8, Line 8 to Page 11, Line 14 and Example 1, the $C_{60}$ formed clearly is a solid. Thus, it was formed in amounts that enables one to discern it as a solid.

## VII. ISSUES ON APPEAL

A. Do the claims on appeal clearly point out and distinctly claim the subject matter which applicants regards as the invention, in compliance with 35 U.S.C. §112, second paragraph?

B. Does the specification describe in accordance with 35 U.S.C. §112, second paragraph, macroscopic amounts of $C_{60}$ to support patentability of Claims 45-49, 51-82, 96, 203 and 232?

C. Is the specification enabling under 35 U.S.C. §112, first paragraph, so as to allow one skilled in the art to make and use macroscopic amounts of $C_{60}$, to support patentability of Claims 45-49, 51-82, 96, 203 and 232?

## VIII. GROUPING OF THE CLAIMS

The claims involved in Issue A do not stand or fall together. A rejection under 35 U.S.C. §112, second paragraph, is based upon the allegation by the United States Patent and Trademark Office that the claims fail to define with particularity the subject matter recited therein. Since this is a rejection which is totally dependent on the language of each claim and since each claim utilizes different language, each of the claims are to be considered independently of each other.

The Office Action alleges three separate grounds in support of its rejection under 35 U.S.C. §112, second paragraph. In the first instance the Office Action has rejected Claims 45, 181 and 233-234 and those dependent therein under 35 U.S.C. §112, second paragraph, alleging that the term "solid" is indefinite. The claims which are rejected on this ground include Claims 45-49, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 203, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247 and 248. These claims stand or fall together, subject to the following caveats. Many of these claims, such as Claims 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82 and 203 are multiple dependent claims and are also ultimately dependent upon Claim 232, which was not rejected for the aforementioned ground. Thus, an aspect of the latter claims will not stand or fall together with the former claims listed herein. Moreover, as described hereinbelow, the term "solid" is

used differently in Claim 45 and those dependent thereon than in Claims 181 and 233-274 and the claims dependent thereon. Thus, Claims 45, 46, 47, 48, 49, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81 and 82 do not stand or fall together with Claims 203, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247 and 248.

In the second ground, it is alleged that the language in "amounts (or quantities) (of $C_{60}$) sufficient to be capable of producing a...colored solution when extracted with sufficient (or effective) amounts of benzene" recited in Claim 83, 84 and 222 is vague and indefinite. These three claims stand or fall together with respect to this issue.

Finally, in the third ground, it is alleged that the term "discernible" in Claim 234 and claims dependent thereon is vague and indefinite. Claims 235, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247 and 248 are not only dependent upon Claim 234, but are also dependent upon Claim 233, which was not rejected on this ground. Thus, these claims will stand or fall together with respect to the subject matter dependent on Claim 234. However, that aspect of these claims dependent on Claim 233 will not stand or fall together with Claim 234.

The rejected claims involved in Issue B stand or fall together.

The rejected claims involved in Issue C stand or fall together.

## IX. ARGUMENTS FOR PATENTABILITY

**A. The claims comply with 35 U.S.C. §112, second paragraph and particularly point out and distinctly claim the subject matter which applicants regard as the invention.**

The claims rejected under 35 U.S.C. §112, second paragraph, viz., Claims 45-49, 51, 84, 96, 181 and 203-248 clearly point out and distinctly claim the subject matter which applicants regard as the invention. Contrary to the allegations in the Final Rejection, the claims on appeal define the metes and bounds therein with sufficient clarity for an infringer to determine whether his acts would or would not constitute an infringement.

Each of the instances alleged by the Office Action in support of the rejection under 35 U.S.C. §112, second paragraph, is in error, as demonstrated hereinbelow.

In support of the rejection under 35 U.S.C. §112, second paragraph, the Office Action alleges that the term "solid" in Claims 45, 181, 233 and 234 and those dependent thereon is unclear, that the term "amounts (or quantities) (of $C_{60}$) sufficient to be capable of producing a colored solution when extracted with sufficient (or effective) amounts of benzene," as recited in Claims 83, 84, and 222 is unclear and that the term "discernible" in Claims 234 and those dependent thereon is unclear.

Appellants disagree for the reasons given hereinbelow with respect to each ground which is alleged to support the rejection. Appellants respectfully submit that the claims on appeal comply with the requirements of 35 U.S.C. §112, second paragraph.

35 U.S.C. §112, second paragraph requires that the specification shall conclude with one or more claims which particularly point out and distinctly claim the subject matter which the applicant regards as his invention. Whether a claim is invalid for indefiniteness

requires a determination of whether those skilled in the art would understand what is claimed when the claim is read in light of the specification. Orthokinetics, Inc. v. Safety Travel Chairs, Inc., 806 F.2d 1565, 1576, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986). The legal standard of definiteness is whether a claim reasonably apprises those of ordinary skill in the art of its scope. See, Amgen, Inc. v. Chugai Pharmaceutical Co., 927 F.2d 1200, 1217, 18 USPQ2d 1016, 1030 (Fed. Cir.), cert denied, 502 U.S. 856, 112 S. Ct. 169 (1991). Case law has held that where the language is as precise as the subject matter permits, the claims are not invalid for indefiniteness. Shatterproof Glass Corp. v. Libbey-Ownes Ford Co., 758, F.2d 613, 624, 225 USPQ 634, 641 (Fed. Cir. 1985) cert dismissed, 474 U.S. 976 (1985).

There is no question that the term "solid" is a term of art that is well understood by those of ordinary skill in the art, whether it be chemists or physicists. They know what is a solid or what is not a solid. However, the Office Action, in rejecting the claims is not alleging that the term "solid" is unclear, it is alleging that it is not clear as to what is the lower limit as to how much material constitutes a solid.

Case law has held that lower limits need not be recited to be incompliance with 35 U.S.C. §112, second paragraph. In re Kirsch, 498 F.2d 1389, 1393-1394, 182 USPQ 286, 296 (CCPA 1974). Even if one could not define with precision the lower limit, that does not make the present claim inprecise. If the claims read in light of the specification reasonably apprise those skilled in the art of the scope of the invention, Section 112, demands no more. Hybritech., Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1385, 231 USPQ 81, 94-95 (Fed. Cir. 1986), cert denied, 480 US 947 (1987).

When each of the claims are read in light of the specification, the meaning of the term solid becomes quite clear. In Claim 45 and claims dependent thereon, it is recited that the $C_{60}$ is capable of being extracted in macroscopic amounts and in solid form. Thus, it is clear that in Claim 45, the term "solid" is meant to convey that the $C_{60}$ being extracted is a solid, not a liquid or gas. As the specification clearly shows in several instances, the $C_{60}$ that is isolated from the process described therein is a solid. For example, it is described as a dark brown to black crystalline material on Page 7, Line 22 of the instant specification; and as a powder on Page 16, Lines 26-27 thereof. In fact, the specification discusses the X-ray diffraction pattern of the crystals of $C_{60}$, see Pages 8, Line 21 to Page 11, Line 14 of the instant specification. Thus, from this description it is clear that $C_{60}$ is a solid, as opposed to a liquid or a gas. Therefore, the meaning of the term "solid" in Claims 45 and those dependent thereon is quite clear and definite.

In Claim 181, the term is used in the context that the "$C_{60}$ molecule is present in amounts capable of extracting therefrom said $C_{60}$ in solid form" and that the $C_{60}$ is extracted in "solid form".

In describing the product, the specification in several instances refers to it as a "solid". For example, on Page 7, Line 15, the specification refers to the $C_{60}$ product as microcrystalline. On Page 8, Line 7, to Page 11, Line 14 the crystalline structure of the $C_{60}$ was described. In Example 1, the product was described as a microcrystalline residue and it was also described as a powder. The inventors were capable of describing the $C_{60}$ product in these terms because the product was produced in amounts sufficient to be perceived as a solid. Thus, for example, if the $C_{60}$ product were prepared in macroscopic amounts, the $C_{60}$ would

be in sufficient quantity to be seen and perceived as a solid. Thus, the meaning of "solid" in Claim 181, especially when read in light of the specification is clear; sufficient product is formed so that it is perceived as a solid.

The term "solid" is used similarly in Claims 233 and 234. The term "solid" is only used in steps "a" and "d" in Claims 233 and in step "a" and "b" in Claim 234. In pertinent part, Claim 233 recites:

> (a) vaporizing elemental carbon in the presence of an inert quenching gas at a pressure ranging from less than 1 atmosphere up to a pressure of 10 atmosphere under conditions effective to form a sooty carbon product comprising $C_{60}$ in quantities sufficient to isolate $C_{60}$ as a solid when extracted from the sooty carbon product…
>
> (d) extracting $C_{60}$ from said sooty carbon product in quantities sufficient to isolate $C_{60}$ as a solid … (emphasis added).

Thus, in view of the teachings in the specification, for the reasons given hereinabove, it is clear that the meaning thereof is that $C_{60}$ is produced in quantities sufficient to be perceived as a solid. In fact, this concept is explicitly recited in Claim 234 with the use of the word discernible in Claim 234:

> A process for preparing $C_{60}$ comprising:
>
> (a) vaporizing elemental carbon in the presence of an inert quenching gas…under conditions effective to form a sooty carbon product comprising $C_{60}$ in quantities sufficient to isolate $C_{60}$ as a discernible solid when extracted from the sooty carbon product;
>
> (b) extracting $C_{60}$ from said sooty carbon product in quantities sufficient to isolate $C_{60}$ as a discernible solid.

How can anything be more definite? One skilled in the art can easily comprehend when a solid is isolated in sufficient quantities so that it is perceived as a solid. This quantity can easily be determined by techniques known to one of ordinary skill in the art. Thus, there is no vagueness or indefiniteness in the amount produced.

With respect to the rejection of Claims 83, 84, and 222, the Office Action alleges that the language, "amount (or quantities) (of $C_{60}$) sufficient to be capable of producing a colored solution when extracted with sufficient (or effective) amounts of benzene" is unclear. Applicants disagree for the same reasons as hereinabove. This language connotes that sufficient ($C_{60}$ or $C_{70}$) is present so that when dissolved in a non-polar organic solvent, such as benzene, the non-polar organic solvent will become colored. Again, this is an objective test of whether appreciable amounts of $C_{60}$ and/or $C_{70}$ are formed. If the benzene solution remains clear when the soot comprising $C_{60}$ and $C_{70}$ is placed into sufficient benzene to dissolve the $C_{60}$ and/or $C_{70}$, then insufficient amounts of product are generated; on the other hand, if the benzene solution becomes colored, then a sufficient amount of $C_{60}$ or $C_{70}$ is generated. The United States Patent and Trademark Office raises the issue that this is indefinite; however, the test is color versus no color, i.e., something which is easily determinable and discernible, and which is an objective rather than a subjective standard.

In both situations, the United States Patent and Trademark Office has failed to consider the history regarding fullerenes. Heretofore, no one had generated enough fullerenes, such as $C_{60}$, to be seen with the naked eye, perceived in solid form, or as indicated in Curl, et al., in Scientific American, 1991, Page 55, when dissolved in benzene produced a colored solution. Others heretofore could not generate sufficient amounts of $C_{60}$ to obtain a colored

solution. For example, when Smalley, et al. placed the soot they produced in benzene, the solution remained clear and the black soot sat on the bottom of the liquid. Id. However, the methodology of the present process produces such appreciable amounts of $C_{60}$ that a colored solution is formed when the $C_{60}$ extracted from the soot prepared in accordance with the present invention is placed into benzene. Not only does this distinguish over the prior art, but as indicated hereinabove, these are simple tests to easily ascertain whether the requisite amount of product is produced.

The Office Action appears to have misinterpreted the claims; it utilizes as the standard the amount of sooty carbon product produced which when placed into benzene forms a colored solution. The claims do not use this as the criteria, since the soot goes to the bottom of the liquid. The color is formed when sufficient amounts of $C_{60}$ and/or $C_{70}$ are present in the soot sample and are dissolved in the benzene. Thus, if a colored solution is produced under these circumstances, then it meets the criteria recited in Claims 83, 84 and 222.

The Office Action has rejected Claim 234 and those dependent therefrom, alleging that the term "discernible" is indefinite. Applicants disagree. The term "discernible" is not an ambiguous term but used in its normal everyday meaning. Attention is directed to Page 360 of Webster's Ninth New Collegiate Dictionary, already of record. It defines discern as follows: "...a: to detect with the eyes, b: to detect with other senses then vision, c: to recognize or identify as separate and distinct." The use of this term does not make the claim indefinite; on the contrary, it adds clarity to the claim for it is clear that is meant to connote that the product is being formed in amounts that could be perceived. Again, for the reasons given herein, this language is unambiguous and clearly defines the metes and bounds of the

claim.

Thus, contrary to the allegations in the Office Action, the claims clearly define their metes and bounds and are not indefinite. Therefore, the rejection of Claims 46-49, 51-84, 96, 181, 203-248 under 35 U.S.C. §112, second paragraph is an error. Reversal thereof is respectfully requested.

**B. There is adequate descriptive support for the term "macroscopic" amounts of $C_{60}$ in the underlying specification, in compliance with 35 U.S.C. §112, first paragraph.**

The term "macroscopic" as used, in the rejected claims is fully supported by the underlying specification. The term "macroscopic" as used in the rejected claims is used in association with amounts of $C_{60}$. Contrary to the allegations in the Final Rejection, in this context, there is adequate support, in accordance with the written description requirement, of 35 U.S.C. §112, first paragraph, for the term "macroscopic amounts of $C_{60}$".

The adequate written description requirement of 35 U.S.C. §112, first paragraph, provides that:

> [t]he specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise and exact terms so as to enable any person skilled in the art to which it pertains or with which it is most nearly connected to make and use the same… (emphasis added).

The adequate written description requirement, which is distinct from the enablement and best mode requirement, serves to ensure that applicants have possession of the invention at the time of the filing of the application. In re Wertheim, 541 F.2d 257, 262, 191 USPQ 90, 96 (CCPA 1976). In order to meet the written description requirement, the

applicant does not have to use any particular form of disclosure to describe the subject matter, but the "description must clearly allow persons of ordinary skill in the art to recognize that [he or she] invented what is claimed." In re Gosteli, 872 F.2d 1008, 1012, 10 USPQ2d 1614, 1618 (Fed. Cir. 1989). In other words, the applicants must convey with reasonable clarity to the skilled artisan that as of the filing date he or she was in possession of the invention. Vas Cath., Inc. v. Mahurkar, 935 F.2d 1555, 1563-64, 19 USPQ 2d 1111, 1117 (Fed. Cir. 1991). Literal support is thus not necessary for compliance with the description requirement. Id.

There is adequate support in the application for the term "macroscopic". More specifically, support for this term and concept permeate the specification. For example, attention is directed to Example 1 of the instant specification wherein it is specified that the $C_{60}$ product is obtained as a powder and wherein the color of the product produced therefrom is indicated. Obviously, the isolation of a product as a powder taken together with the fact that it is a colored powder connotes that the product could be seen with the naked eye, consistent with the use of macroscopic amounts recited in the claims. Furthermore, attention is directed to Page 7, Lines 10-25 of the specification, where it describes that when the sooty product was placed into a non-polar solvent, e.g., benzene, the benzene became colored and the product produced after extraction with the non-polar solvent is colored. Obviously, one cannot determine these characteristics unless it is present in amounts that can be seen with the naked eye, i.e., macroscopic amounts. For example, if less than macroscopic amounts were produced, no color would be seen. See, Curl, et al, Scientific American 1991, 54-55. In addition, attention is directed to Page 11, Line 30 of the instant specification wherein it is indicated that the IR is taken of an approximately two micrometer thick $C_{60}$ coating on a

silicon substrate. Especially since $C_{60}$ is colored, it is obvious that this coating had to be seen with the naked eye. Furthermore, the application makes additional references to characteristics of the product that can only be discernible if the material is present in macroscopic amounts. For example, the application describes that the product produced by sublimation of the carbon soot can range from a uniform film to a coating, and the color is brown to gray depending on the thickness of the coat formed, while the product obtained from extraction is a dark brown to black crystalline material. Obviously, these characteristics, especially color, can be differentiated if the product was produced in amounts that can be seen with the human eye. In addition, on Page 2, Line 13, the application states that before the prior invention, no one had made $C_{60}$ or $C_{70}$ in appreciable amounts. The implication is that the present inventors were successful in achieving this goal, consistent with the teachings in the application. Appreciable by definition means "enough to be perceived", See Webster Unbridged Dictionary 2nd Ed. p. 91 (1983), previously submitted. Thus, "appreciable" connotes large quantity, and is consistent with the term "macroscopic". All of these descriptions taken together as a whole connote that the $C_{60}$ was produced in macroscopic amounts.

Attention is further directed to the Kroto Declaration dated June 9, 1995, previously submitted, especially Paragraphs 14 and 15, in which he attests that the application adequately describes the method for making macroscopic amounts of fullerenes, such as $C_{60}$ and $C_{70}$, and that based upon the teachings in the application, it is his opinion that the inventors had in their possession at the time of the filing of the application macroscopic amounts of same. Kroto, who is a skilled artisan in the field, and who won a Nobel Prize in

Chemistry for discovering fullerenes, understood from reading the application that the applicants had made macroscopic amounts of e.g., $C_{60}$ and had it in their possession at the time of the filing of the application, providing further evidence that there is adequate support in the specification for the term "macroscopic". Yet, the Final Rejection never comments or discusses Dr. Kroto's testimony. Since a skilled artisan testified that the application describes the production of fullerenes, such as $C_{60}$, in macroscopic amounts, how can the United States Patent and Trademark Office ignore or dismiss such a statement? Case law had held that if a person of ordinary skill in the art would have understood from reading the specification that the inventor had possession of the claimed invention at the time of filing the application, then the written description required by 35 U.S.C. §112, first paragraph, is met. In re Alton, 76 F.3d 1168, 37 USPQ2d 1578 (Fed. Cir. 1996). Dr. Kroto's testimony on this issue is the only evidence on the record from a skilled artisan. The United States Patent and Trademark Office may be knowledgeable about several subjects, but it is not one of ordinary skill in the art. The United States Patent and Trademark Office has not provided any testimony from a skilled artisan. Moreover, as indicated hereinabove the determination of whether the specification has adequate support for a particular subject matter is based on whether one of ordinary skill in the art would have understood from the teachings in the specification that the inventor had possession of the claimed invention at the time of the filing of the application. The testimony from Dr. Kroto is undisputed factual evidence on this issue. In view of this evidence and in the absence of any evidence to the contrary, it is respectfully submitted that only one conclusion can be reached-- that the written description requirement under 35 U.S.C. §112, first paragraph is met.

Attention in this regard is also directed to the Supplemental Declaration of Harold W. Kroto under 37 C.F.R. §1.132. Dr. Kroto testifies that the specification provides evidence in several instances that the inventors had produced $C_{60}$ in macroscopic amounts. For example, he refers to Example 1, which "describes the product thereof in powder form as brownish-red. Such language connotes, in my opinion, that the product thereof could be seen with the naked eye..." This testimony is consistent with the position of appellant hereinabove.

Thus, Dr. Kroto testimony clearly evidences that he read the application and that the application clearly conveys to one of ordinary skill in the art that the inventors had produced $C_{60}$ in macroscopic amounts. This testimony cannot be ignored by the United States Patent and Trademark Office. See, In re Alton, 76 F.3d 1168, 37 USPQ2d 1578 (Fed. Cir. 1996).

Moreover, further attention is directed to Paragraphs 15 and 17-19 which are produced in part hereinbelow.

In Paragraph 15 of the Declaration Kroto further testifies as follows:

> Moreover, based upon repetition of the process described therein, as described hereinbelow, the process as described in the above-identified application, especially in Example 1, inherently produces fullerenes, e.g., $C_{60}$, in amounts that could be seen with the naked eye.

Dr. Kroto further testifies in Paragraphs 17, 18 and 19 of the Declaration as follows:

> 17. Utilizing the procedure exactly as described in the

above-identified application, I have had fullerenes, including $C_{60}$, prepared in macroscopic amounts on numerous occasions since 1990 to the present. More specifically, by following the procedure described in the above-identified application and vaporizing graphite rods in an atmosphere of helium, forming the carbon soot therefrom, collecting the soot and dissolving the soot in benzene, in accordance with the procedure described in the above-identified application, I and my colleagues have prepared and identified various fullerenes, including, inter alia, $C_{60}$...

18. Moreover, by following the procedure described in the above-identified application, and in accordance with the procedure outlined in Paragraph 17 herein, we have isolated fullerenes in macroscopic amounts, as defined herein. For example, utilizing the procedure outlined in Paragraph 17, I have found that the smoky carbon product contains 5 to 10% $C_{60}$ and 1% $C_{70}$. We routinely produce the soot in 1-5 gram quantities and routinely extract 100-500 milligram amounts batchwise. Thus, one kilogram of sooty carbon product produces, on average, 100g of $C_{60}$, 10g of $C_{70}$ and 1 gram of other fullerenes, such as those indicated hereinabove. The various fullerenes formed can and are isolated in accordance with the isolation and purification procedures described in the above-identified application, without an undue amount of experimentation. Furthermore, the various fullerenes are isolated as solids, which are easily visible to the naked eye. For example, in a typical experiment conducted according to the procedure described in the above-identified application, $C_{60}$ is formed in about 100 mg quantities, $C_{70}$ in about 10 mg quantities and the remainder in about 1 mg quantities.

19. Thus, by following the procedure described in the above-identified application, I have found that the process described therein inherently produces ... $C_{60}$, in macroscopic amounts. In fact, by following the procedure of Kratschmer and Huffman, outlined in the above identified application, crystalline material of fullerenes, including $C_{60}$, is produced which can be seen

with the naked eye.

Thus, Dr. Kroto testifies that by following the procedure in the teachings in the above-identified application, one of ordinary skill in the art produces, inter alia, macroscopic amounts of $C_{60}$. In other words, Dr. Kroto testifies that $C_{60}$ is inherently produced in macroscopic amounts if one of ordinary skill in the art follows the teachings in the above-identified application for producing same.

Case law has held that words describing a function or property that was inherent in the specification is considered to be supported by the disclosure and supports the adequate written requirement, in accordance with 35 U.S.C. §112, first paragraph. See, In re Reynolds, 443 F.2d 384, 170 USPQ 94 (CCPA 1971). In Reynolds the question was whether words describing a function that was inherent in the claimed product could be added to the specification by amendment, or whether such description was "new matter". The court cited with approval the holding in Technicon Instruments Corp. v. Coleman Instrument, Inc., 255 F.Supp. 630, 640-641, 150 USPQ 227, 236 (N.D. Ill. 1966), aff'd, 385 F.2d 391, 155 USPQ 369 (7th Cir. 1967), that: "By disclosing in a patent application a device that inherently performs a function, operates according to a theory, or has an advantage, a patent applicant necessarily discloses that function, theory, or advantage even though he says nothing concerning it." In re Reynolds, 433 F.2d at 389, 170 USPQ at 98. It was concluded that the express description of the inherent property, since not "new matter", could be added to the specification with effect as of the original filing date. Id.

Therefore, the disclosure in an application of an inherent property satisfies the written description requirement with respect to that property. Id., see also, Kennecott Corp. v.

Kyocera International Inc., 835 F.2d 1419, 1422, 5 USPQ2d 1194, 1197 (Fed. Cir. 1987), cert. denied, 486 U.S. 1008 (1988).

This case not only is relevant but is instructive. Dr. Kroto's testimony indicates that the process described in the underlying application inherently produces $C_{60}$ in macroscopic amounts. In accordance with the holding of Reynolds, the inherent production of $C_{60}$ in macroscopic amounts provides adequate support for the term "macroscopic" to be used in the claims.

Accordingly, one can reach only one conclusion with respect to the issue of the written description for the term "macroscopic amounts of $C_{60}$"; that is there is adequate support, in compliance with the description requirement of 35 U.S.C. §112, first paragraph for the term "macroscopic" amounts of $C_{60}$.

Attention is also directed to the Decision of the Board of Patent Appeals and Interferences ("Board") dated September 23, 1999, Pages 30-37, in the record wherein the Board held that it interpreted the term "macroscopic" to be used in its ordinary well accepted meaning of visible with the naked human eye (Page 36) and where the Board held that the specification contained evidence that a product obtained from Example 1 was visible to the eye (Page 35). From these statements, it is apparent that the Board concluded that the specification connotes to the skilled artisan at the time of the filing of the application that the inventors had in their possession a process, which is described in the application, for producing $C_{60}$ in macroscopic amounts.

Thus, contrary to the allegations by the Final Rejection, there is adequate support in the application for the term "macroscopic" amounts of $C_{60}$. Thus, the rejection of

Claims 45-49, 51-82, 96, 203 and 232 under 35 U.S.C. §112, first paragraph, for allegedly failing to describe the invention is reversible error.

**C. Contrary to the allegations in the Office Action, the underlying specification enables one of ordinary skill in the art to make macroscopic amounts of $C_{60}$ without an undue amount of experimentation.**

Case law had held to be enabling under section 112, first paragraph, the patent must contain a description sufficient to enable one skilled in the art to make and use the claimed invention. Raytheon Co. v. Roper Corp., 724 F.2d 951, 960, 220 USPQ 592, 599 (Fed. Cir. 1983), cert. denied, 469 U.S. 835 (1984). A patent may be enabling even though some experimentation is necessary; the amount of experimentation however, must not be unduly extensive. Atlas Powder Co. v. E.I. du Pont de Nemours & Co., 750 F.2d 1569, 1576, 224 USPQ 409, 413 (Fed. Cir. 1984).

The Office Action does not question whether the specification enables one to make $C_{60}$. Even the Office Action alleges that the specification is enabling for the preparation of a two-micron thick $C_{60}$ coating. Thus, the Office Action concurs that the specification is enabling to make $C_{60}$. The Office Action however, alleges that the specification is not enabling for making $C_{60}$ in macroscopic amounts. Thus, the issue becomes whether the specification is enabling for making $C_{60}$ in macroscopic amounts.

It is apparent that the United States Patent and Trademark Office is basing its rejection of non-enablement on the incorrect belief that the application only describes the preparation of a two micron thick $C_{60}$ coating. Even if it were true, which it is not the case, as shown in the previous section, and the application only describes the preparation of a two

micron thick $C_{60}$ coating, that does not necessarily mean that the application cannot be enabling for the preparation of, inter alia, $C_{60}$ in macroscopic amounts.

Case law has held that the enablement requirement is separate and distinct from the description requirement under 35 U.S.C. §112, first paragraph. Vas Cath, Inc. v. Mahurker, 935 F2d 1555, 1563-1564, 19 USPQ2d 1111, 1117 (Fed. Cir. 1991). It is in error for the United States Patent and Trademark Office to reject the claims for lack of enablement on this basis alone, especially in view of the evidence of record.

Contrary to the allegations of the Office Action, the specification fully complies with the enablement requirement of 35 U.S.C. §112, first paragraph, and adequately teaches one skilled in the art how to make the claimed invention without an undue amount of experimentation. The specification provides on Pages 3-7 thereof the general teaching to the skilled artisan of how to prepare, inter alia, $C_{60}$ in macroscopic amounts. Further, specific examples are provided in the application. Attention is directed to Example 1. Example 1 describes in great detail the process of producing $C_{60}$ in macroscopic amounts. Based on the evidence in the record, it is clear that if the skilled artisan follows the procedures described in the specification, including the specific examples, macroscopic amounts of $C_{60}$ are produced without an undue amount of experimentation. For example, attention is again directed to the Declaration of Dr. Kroto, dated June 9, 1995, Paragraph 3 wherein he testifies that the

> "application teaches in clear detail to the skilled artisan the preparation of fullerenes, including $C_{60}$, in quantities that were never recognizably achieved before the discovery of Huffman and Kratschmer described in the application. Specifically, the application describes methods for the production of $C_{60}$ and $C_{70}$ in macroscopic amounts, i.e., amounts that could be seen with the naked eye (inherently at least $10^{18}$ molecules of product).

Moreover, in Paragraph 15, Dr. Kroto testifies:

> 15. In my professional judgment the above-identified application adequately teaches to the skilled artisan how to make macroscopic amounts of the fullerenes, including $C_{60}$ and $C_{70}$.

Attention is also directed to the Supplemental Declaration of Dr. Kroto, paragraphs 8 and 15-19, wherein he attests that the application adequately describes how to make fullerenes, including $C_{60}$, in macroscopic amounts and wherein he testifies that in accordance with the teachings, he has made macroscopic amounts of $C_{60}$ without an undue amount of experimentation. See Paragraphs 18 and 19 thereof in particular:

> 18. Moreover, by following the procedure described in the above-identified application...we have isolated fullerenes in macroscopic amounts. For example, ... we have found that the smoky carbon product contains 5 to 10% $C_{60}$ and 1% $C_{70}$. We routinely produce the soot in 1-5 gram quantities and routinely extract 100-500 milligram amounts batchwise. Thus, one kilogram of sooty carbon product produces, on average, 100 g of $C_{60}$...Various fullerenes formed can and are isolated in accordance with the isolation and purification procedures described in the above-identified application, without an undue amount of experimentation.
>
> 19. Thus, by following the procedure described in the above-identified application. I have found that the process described therein inherently produces several species of fullerenes, including $C_{60}$, in macroscopic amounts... (Emphasis added)

In fact, by following the procedure of Kratschmer and Huffman, outlined in the above-identified application, crystalline material of fullerenes including $C_{60}$, is produced which can be seen with the naked eye.

Dr. Kroto thus testifies that the procedure described in the underlying application is so sufficiently detailed that he was able to make inter alia, $C_{60}$ in macroscopic amounts. Moreover, Dr. Kroto characterized the procedure as routine without an undue amount of experimentation. See also discussions in the previous section.

The fact that Dr. Kroto could make $C_{60}$ in macroscopic amounts by following the teachings therein without an undue amount is unequivocal evidence that the application contains an enabling description on how to make fullerenes in macroscopic amounts without an undue amount of experimentation. Thus is clearly powerful evidence on the issue of enablement. Yet, it is completely ignored and not even addressed in the Final Rejection. It is improper for the United States Patent and Trademark Office to ignore the testimony of Dr. Kroto, a skilled artisan, especially since there is no evidence on the record to dispute the facts on which Dr. Kroto testifies. In re Alton.

Therefore, since the specification provides a detailed description of the steps of the claimed process and since by following the teaching, one produces $C_{60}$ in macroscopic amounts, without an undue amount of experimentation as testified by Dr. Kroto, it necessarily follows that the process in the specification is enabling for the production of $C_{60}$ in macroscopic amounts. Thus, the rejection of Claims 45-49, 51-82, 96, 203 and 232 under 35 U.S.C. §112, first paragraph, for allegedly being non-enabling, is reversible error.

## X. MISCELLANEOUS

Appellants are enclosing herewith a terminal disclaimer in response to the provisional obviousness type double patenting rejection of Claims 45-49, 51-84, 96, 181, 203-248 over Claim 57-63 and 68-87 of copending Application Number 08/486,669. The terminal

disclaimer is attached as Exhibit B hereto.

Case law has held that a rejection based on a non-statutory type of double patenting can be avoided by filing a terminal disclaimer in the application or proceeding in which the rejection is made. In re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970). The submission of a terminal disclaimer thus overcomes the provisional obviousness double patenting rejection of Claims 45-49, 51-84, 96, 181, 203-248 over Claims 57-63 and 68-87 of copending application no. 08/486,669.

## XI. CONCLUSION

The above arguments and the submission of the terminal disclaimer clearly overcome the rejections in the Final Action and clearly establish that all of the claims on appeal are patentable. Affirmance of the patentability and reversal of the Final Rejection of the claims on appeal is respectfully solicited.

Respectfully submitted,

Mark J. Cohen
Registration No. 32,211

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza
Garden City, New York 11530
(516) 742-4343
MJC/bb

A.

**CLAIMS PENDING IN USSN 08/236,933 - OUR DOCKET 7913ZAZY**

45. A process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to form a sooty carbon product comprising $C_{60}$ molecules, said $C_{60}$ molecules being present in said sooty carbon product in amounts capable of extracting therefrom said $C_{60}$ in macroscopic amounts and in solid form; and

(b) extracting $C_{60}$ in macroscopic amounts.

46. The process according to Claim 45 wherein said extracted $C_{60}$ is in solid form.

47. The process according to Claim 45 wherein said extracted $C_{60}$ is in solution.

48. The process according to Claim 47 wherein said extracted $C_{60}$ is in solution of a non-polar organic solvent.

49. The process according to Claim 48 wherein the non-polar organic solvent is benzene, toluene, carbon tetrachloride, 1,1,1-trichloroethane, xylene or alkanes having 5-10 carbon atoms.

51. The process according to Claim 232 wherein said extracted $C_{60}$ is in solid form.

52. The process according to Claim 232 wherein said extracted $C_{60}$ is in solution.

53. The process according to Claim 52 wherein said extracted $C_{60}$ is in solution of a non-polar organic solvent.

54. The process according to Claim 53 wherein said non-polar organic solvent is benzene, toluene, carbon tetrachloride, 1,1,1-trichloroethane, xylene or alkanes having 5-10 carbon atoms.

55. The process according to Claim 46 or 51 wherein the $C_{60}$ in solid form is a crystalline solid.

56. The process of Claim 55 wherein the $C_{60}$ in solid form is substantially pure solid $C_{60}$.

57. The process of Claim 55 wherein the $C_{60}$ in solid form is substantially pure crystalline $C_{60}$.

58. The process of Claim 45 or 232 wherein $C_{70}$ is additionally present in the sooty carbon product and is additionally extracted therefrom.

59. The process of Claim 45 or 232 wherein $C_{70}$ is additionally present in sooty carbon product and is separated from the $C_{60}$.

60. The process of Claim 59 wherein the $C_{70}$ separated from said $C_{60}$ is substantially pure solid $C_{70}$.

61. The process of Claim 60 wherein the substantially pure solid $C_{70}$ is substantially pure crystalline $C_{70}$.

62. The process according to Claim 45 or 232 wherein extracting comprises contacting the sooty carbon product with a non-polar organic solvent effective to dissolve the $C_{60}$, said solvent being present in amounts sufficient to dissolve the $C_{60}$ present in said sooty carbon product.

63. The process according to Claim 62 wherein extracting further comprises separating from said solvent a solid $C_{60}$.

64. The process of Claim 45 or 232 wherein extracting comprises subliming the $C_{60}$ from the sooty carbon product and condensing the sublimed $C_{60}$.

65. The process of Claim 232 wherein depositing step comprises collecting the sooty carbon product on a collecting surface distanced 5-10 cm from said vaporization.

66. The process of Claim 45 or 232 wherein the elemental carbon is placed into an evacuated reactor prior to the vaporization thereof.

67. The process of Claim 45 or 232 wherein the elemental carbon is vaporized in a bell jar carbon evaporator.

68. The process of Claim 45 or 232 wherein the elemental carbon subject to vaporization is graphite, or amorphous or glassy carbon.

69. The process of Claim 68 wherein the elemental carbon subject to vaporization is graphite.

70. The process of Claim 45 or 232 wherein the elemental carbon subject to vaporization is graphite rods.

71. The process of Claim 45 or 232 wherein the elemental carbon is vaporized by passing an electrical current of sufficient intensity through said carbon source to produce the sooty carbon product.

72. The process of Claim 71 wherein the electrical current is about 100 amps.

73. The process of Claim 45 or 232 wherein the inert quenching gas is a noble gas.

74. The process of Claim 73 wherein the noble gas is helium or argon.

75. The process of Claim 73 wherein the collecting substrate is a glass surface.

76. The process of Claim 62 wherein the non-polar organic solvent is carbon disulfide, benzene, carbon tetrachloride or toluene.

77. The process of Claim 76 wherein the solvent is benzene.

78. The process of Claim 63 wherein separating the solid $C_{60}$ from the solvent comprises evaporating the solvent.

79. The process of Claim 63 further comprising the step of purifying the solid $C_{60}$.

80. The process of Claim 79 wherein the purifying step is sublimation, crystallization, column chromatography, capillary electrophoresis, HPLC, preparative thin-layer chromatography or extraction.

81. The process of Claim 64 wherein the $C_{60}$ is sublimed from the sooty carbon product at 300-400°C.

82. The process of Claim 64 wherein the sublimation step comprising heating the $C_{60}$ is a vacuum or inert atmosphere

at effective sublimation temperatures to extract $C_{60}$ from said sooty carbon product.

83. A process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to form a sooty carbon product comprising $C_{60}$ molecules, said $C_{60}$ molecules being present in said sooty carbon product in amounts sufficient to be capable of providing a visibly colored solution when extracted with sufficient amounts of benzene; and

(b) extracting $C_{60}$ from said sooty carbon product in amounts sufficient to provide a visibly colored solution when extracted with benzene in amounts sufficient to dissolve the $C_{60}$ present in said sooty carbon product.

84. A process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to provide a sooty carbon product comprising $C_{60}$ molecules, said $C_{60}$ molecules being present in said sooty carbon product in amounts sufficient to be capable of providing a visibly colored solution when extracted with benzene;

(b) depositing the sooty carbon product on a collecting surface;

(c) removing the sooty carbon product from the collecting surface; and

(d) extracting product which is predominantly $C_{60}$ from said sooty carbon product, said $C_{60}$ being present in sufficient

quantities to provide a visibly colored solution when extracted with benzene present in amounts sufficient to dissolve the $C_{60}$ present in said sooty carbon product.

96. The process of Claim 232 wherein the depositing step comprises collecting the sooty carbon product on a collecting surface distanced 5-10 cm from said vaporization.

181. A process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to form a sooty carbon product comprising $C_{60}$ molecules, said $C_{60}$ molecules being present in said sooty carbon product in amounts capable of extracting therefrom said $C_{60}$ in solid form; and

(b) extracting in solid form $C_{60}$ from said sooty carbon product.

203. The process according to Claim 62 wherein extracting further comprises evaporating the solvent off, thereby forming a residue, and subliming the $C_{60}$ from said residue.

204. A process for preparing $C_{60}$ comprising

(a) vaporizing elemental carbon in the presence of an inert quenching gas at a pressure sufficient to generate a sooty carbon product comprising $C_{60}$, said $C_{60}$ being present in said sooty carbon product in sufficient amounts to produce and collect therefrom crystalline $C_{60}$;

(b) separating said $C_{60}$ from said sooty carbon product under conditions effective to recover crystalline $C_{60}$.

205. The process according to Claim 204 wherein the pressure is less than 1 atmosphere.

206. The process according to Claim 205 wherein the pressure is at least about 50 torr.

207. The process according to Claim 206 wherein the pressure ranges from about 50 to about 400 torr.

208. The process according to Claim 204 wherein $C_{70}$ is additionally present in the sooty carbon product.

209. The process of Claim 204 wherein $C_{70}$ is additionally present in the sooty carbon product and is separated from the sooty carbon product and is additionally present in the crystalline $C_{60}$.

210. The process according to Claim 209 wherein said $C_{70}$ is separated from the crystalline $C_{60}$.

211. The process according to Claim 204 wherein said crystalline $C_{60}$ is substantially pure crystalline $C_{60}$.

212. The process according to Claim 204 wherein the elemental carbon is graphite, amorphous carbon or glassy carbon.

213. A process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon to form carbon vapor in an atmosphere of an inert gas;

(b) quenching said carbon vapor in said inert gas under conditions sufficient to effectively condense and nucleate said vapor to form a sooty carbon product comprising $C_{60}$ molecules in sufficient quantities to extract therefrom an amount sufficient to collect said $C_{60}$ as a crystalline product;

(c) collecting said sooty carbon product;

(d) separating said $C_{60}$ from said sooty carbon product and recovering therefrom said $C_{60}$ in crystalline form.

214. The process according to Claim 213 wherein the inert gas is helium or argon.

215. The process according to Claim 213 wherein the carbon vapor is quenched for a sufficient distance from the situs of vaporization to form said sooty carbon product.

216. The process according to Claim 215 wherein said distance is about 5 to 10 cm from the situs of vaporization.

217. The process according to Claim 213 wherein the $C_{60}$ recovered therefrom is substantially pure crystalline $C_{60}$.

218. The process according to Claim 213 wherein $C_{70}$ is additionally present in the sooty carbon product and is additionally present in the carbon product and is additionally present in the crystalline product.

219. The process according to Claim 213 wherein the $C_{60}$ is separated from $C_{70}$.

220. The process according to Claims 213 wherein the quenching gas is at a pressure less than 1 atmosphere.

221. The process according to claim 220 wherein the pressure ranges from about 50 torr to about 400 torr.

222. A process for producing $C_{60}$ comprising:

(a) vaporizing elemental carbon in an atmosphere of an inert gas at a pressure sufficient to generate a sooty carbon product comprising $C_{60}$; said $C_{60}$ being present in sufficient

quantities to recover therefrom $C_{60}$ in amounts to be discernible as a colored solid;

(b) separating said $C_{60}$ from said sooty carbon product under conditions effective to recover therefrom a colored crystalline $C_{60}$.

223. The process according to Claim 222 wherein the pressure is less than 1 atmosphere pressure.

224. The process according to Claim 223 wherein the pressure in greater than about 50 torr.

225. The process according to Claim 224 wherein the pressure ranges from about 50 torr to about 400 torr.

226. The process according to Claim 222 wherein $C_{70}$ is additionally present in the sooty carbon product.

227. The process according to Claim 222 wherein $C_{70}$ is additionally present in the sooty carbon product and is additionally separated from the sooty carbon product and is present in the crystalline $C_{60}$.

228. The process according to Claim 227 wherein the $C_{70}$ is separated from the crystalline $C_{60}$.

229. The process according to Claim 222 wherein the crystalline $C_{60}$ is substantially pure crystalline $C_{60}$.

230. A process for preparing $C_{60}$ comprising vaporizing elemental carbon selected from the group consisting of graphite, amorphous carbon and glassy carbon in an inert quenching gas at a pressure of at least 50 torr so as to generate a carbon soot comprising $C_{60}$ and separating said $C_{60}$ from said soot under

conditions effective to recover substantially pure crystalline $C_{60}$ therefrom.

231. The process according to Claim 230 wherein the pressure ranges from about 50 torr to about 400 torr.

232. A process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to form a sooty carbon product comprising $C_{60}$ molecules in macroscopic amounts;

(b) depositing the sooty carbon product on a collecting surface remote from said situs of vaporization;

(c) removing the sooty carbon product from the collecting surface; and

(d) extracting a product comprising a macroscopic amount of $C_{60}$ from said sooty carbon product.

233. A process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas at a pressure ranging from less than 1 atmosphere up to a pressure of 10 atmospheres under conditions effective to form a sooty carbon product comprising $C_{60}$ in quantities sufficient to isolate $C_{60}$ as a solid when extracted from the sooty carbon product;

(b) depositing the sooty carbon product on a collecting surface remote from said situs of vaporization;

(c) removing the sooty carbon product from the collecting surface; and

(d) extracting $C_{60}$ from said sooty carbon product in quantities sufficient to isolate $C_{60}$ as a solid when extracted from the sooty carbon product.

234. A process for preparing $C_{60}$ comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under a pressure ranging from less than 1 atmosphere up to 10 atmospheres under conditions effective to form a sooty carbon product comprising $C_{60}$ in quantities sufficient to isolate $C_{60}$ as a discernible solid when extracted from the sooty carbon product;

(b) extracting $C_{60}$ from said sooty carbon product in quantities sufficient to isolate said $C_{60}$ as a discernible solid.

235. The process according to Claim 233 or 234 wherein said elemental carbon is placed into an evacuated reactor prior to the vaporization thereof.

236. The process according to Claim 233 wherein depositing comprises collecting the sooty carbon product on a collecting surface distanced 5-10 cm from said vaporization situs.

237. The process according to Claim 233 or 234 wherein the elemental carbon is vaporized in a bell jar carbon evaporator.

238. The process according to Claim 233 or 234 wherein extracting comprises contacting the sooty carbon product with a non-polar organic solvent effective to dissolve the $C_{60}$, said

solvent being present in amounts sufficient to dissolve the $C_{60}$ present in said sooty carbon product.

239. The process according to Claim 238 wherein said non-polar organic solvent is benzene, toluene, carbontetrachloride, 1,1,1-trichloroethane, xylene or an alkane having 5-10 carbon atoms.

240. The process according to Claim 233 or 234 wherein $C_{70}$ is additionally present in the extracted $C_{60}$.

241. The process of Claim 240 which additionally comprises separating the $C_{70}$ from $C_{60}$.

242. The process according to Claim 233 or 234 which additionally comprises purifying the extracted $C_{60}$ product.

243. The process according to Claim 233 or 234 wherein the product is substantially pure $C_{60}$.

244. The process according to Claim 233 or 234 wherein extracting comprises subliming the $C_{60}$ from the sooty carbon product and condensing the sublimed $C_{60}$.

245. The process according to Claim 233 or 234 wherein the pressure of the vaporization is conducted at a pressure ranging from 50 to 400 torr.

246. The process according to Claim 233 or 234 wherein the extracted product is in solution.

247. The process according to Claim 233 or 234 wherein said extracted $C_{60}$ product is in solution of a non-polar organic solvent.

248. The process according to Claim 246 wherein the non-polar organic solvent is benzene, toluene, carbon tetrachloride, 1,1,1-trichloroethane, xylene or an alkane having 5-10 carbon atoms.